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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/640,340	08/12/2003	Liang Liu		7701

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EXAMINER

STADLER, REBECCA M

ART UNIT PAPER NUMBER

1754

DATE MAILED: 12/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/640,340	<b>Applicant(s)</b> LIU ET AL.	
	<b>Examiner</b> Rebecca M. Stadler	<b>Art Unit</b> 1754	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 10 August 2003.
- 2a) ☐ This action is FINAL.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 8-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7, 18 and 19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. _____  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                                    |

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## **DETAILED ACTION**

### ***Election/Restrictions***

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-7 and 19-20, drawn to a device, classified in class 257, subclass 1+.
- II. Claims 8-18, drawn to a process, classified in class 423, subclass 447.3.

The inventions are distinct, each from the other because of the following reasons:

Inventions II and I are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the product can be made by liquid or solution depositing the catalyst followed immediately by exposure to the carbon gas.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different subject matter and classification, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

During a telephone conversation with Wei Te Chung on November 30, 2005 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-7 and 19-20. Affirmation of this election must be made by applicant in replying to this Office action. Claims 8-18 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the

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application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-7 and 19-20 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The phrase "catalyst-doped material" is not enabled in the specification because there is no mention of a catalyst being doped or a catalyst doping another material. In paragraph 22 of the specification, "the catalyst-doped material is copper." In paragraph 23, "the catalyst-doped can be . . . cobalt, nickel, molybdenum, ruthenium, manganese or a combination of the materials thereof." It appears that the "catalyst-doped material" is merely a layer of one of the above materials or possibly a layer comprising a combination of the materials. There does not appear to be any doping. The Examiner suggests changing the phrase to a "layer of copper, cobalt, nickel, molybdenum, ruthenium, manganese or a combination of materials thereof."

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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Claims 1-7 and 19-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a.) The phrase "catalyst-doped material" is unclear. It is unclear whether a material is doped with a catalyst or whether the catalyst is doped with something else. It appears, in fact, that nothing is doped.

b.) In claims 6 and 19, the phrase "catalyst-doped material gradually increases or decrease" is unclear because it can not be ascertained what increases. Does the height increase? The mass?

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

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invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-5, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dai 6,232,706 in view of Rodriguez 5,653,951 and in further view of the Yao reference.

As to claims 1 and 19, Dai '706 discloses a device comprising: a substrate (see column 3, lines 7-8); with a plurality of nano-sized catalytic particles (see column 3, lines 19-33); and a nanotube array extending from the catalytic particles (see column 3, lines 19-33 and column 4, lines 28-42). Dai '706 does not teach a catalyst material and a catalyst-doped material. However, Rodriguez '951 does teach a catalyst comprised of a Group VIII metal and a Group IB metal (see column 5, lines 20-41). Of note, a preferred combination is comprised of copper in combination with iron (see column 5, lines 35-37). Because this is the same combination of materials as that disclosed in the specification of the present invention, it is axiomatic that the copper of Rodriguez would also be capable of varying a reaction rate of synthesis of carbon nanotubes. It would have been obvious to one of ordinary skill in the art at the time of this invention to use the catalyst material of Rodriguez in the device of Dai in order to take advantage of the structural changes provided by the copper (see column 5, line 54 – column 6, line 10, which teaches that the presence of copper generates structurally different nanotubes than when iron is used alone). Also, it is obvious to optimize catalytic compositions for carbon nanotube processes in order to obtain the desired parameters for nanotube growth. See, e.g., In re Boesch, 617 F.2d 272, 205 U.S.P.Q. 215 (CCPA 1980). Finally, the Yao reference teaches that nanotubes bundles produced by CVD often bend (see Figure 2b, page 11396). As can be seen by the Figure, the nanotubes are bent and also have varying lengths.

As to claim 2, Dai '706 discloses that silicon can be used as the substrate (see column 3, lines 8-10) or that quartz can be used as the substrate (see claim 6, column 6, lines 24-25). The Examiner takes Official Notice that it is well known that glass can be used as a substrate in

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nanotube processes. As such, the quartz and silicon of Dai '706 are taken as representative of a glass substrate.

As to claim 3, Rodriguez '951 discloses all of the catalyst materials with the exception of molybdenum and manganese (see column 5, lines 20-41). However, the Examiner takes Official Notice that molybdenum and manganese are old and well known in the art as effective catalysts for nanotube processes. Therefore, molybdenum and manganese are taken as equivalents of the materials disclosed in Rodriguez.

As to claim 4, Rodriguez '951 discloses copper (see column 5, lines 26-28). See above regarding molybdenum.

As to claim 5, as above the copper of Rodriguez will inherently increase or decrease the growing rates of the carbon nanotubes because it is the same material used as the present invention.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rebecca M. Stadler whose telephone number is 571-272-5956. The examiner can normally be reached on Normal.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stuart L. Hendrickson can be reached on 571-272-1351. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

rms



**STUART L. HENDRICKSON**  
PRIMARY EXAMINER